Notice of Allowability	Application No.	Applicant(s)	
	10/660,864	LIN, SHANG-HUNG	
	Examiner	Art Unit	
	Kanji Patel	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *telephone interview on 1/23/07 and 9/11/03*.

2. ☒ The allowed claim(s) is/are *1-3, 8-9, 11-13, 18-21, 26-27, 29-33 and 38-39 and renumbered as 1-21*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Hong Jong on 1/23/7.

The application has been amended as follows:

In the claims:

Replace claims with the following currently amended one:

1. (Currently Amended) A method for performing chroma suppression for an image sensor system, said method comprising the steps of:

a) determining the intensity of spatial frequency for a current processing pixel within a block of Bayer pattern by using edge detection that utilizes pixels values of green pixels within said block of Bayer pattern; and

b) reducing the chromatic saturation of said current processing pixel based on said determined intensity of spatial frequency of said current processing pixel;

wherein said region of Bayer pattern is a 4 X 4 block of pixels containing said current processing pixel;

wherein said step a) further comprises the steps of:

a1) calculating a first plurality of 4 first order pixel value sums V[0] to V[3], wherein an i-th pixel value sum V[i] characterizes the pixel value sum for a pair of green

pixel values associated respectively with a pair of green pixels lying on the i-th vertical column of said Bayer pattern region; and

a2) calculating a second plurality of 4 first order pixel value sums HI0] to H[3], wherein an j-th pixel value sum H[j] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying in the j-th horizontal column of said Bayer pattern region;

wherein said step a) further comprises the steps of:

a3) calculating Vavg[0] = V[0] + V[2] and Vavg[1] = V[1] + V[3];

a4) calculating Vmax = | Vavg[0] - Vavg[1] |;

a3) calculating Havg[0] = H[0] + H[2] and Havg[1] = H[1] + H[3]; and

a4) calculating Hmax = | Havg[0] - Havg[1] |;

wherein a number GI is used to determine the intensity of spatial frequency of said current processing pixel, wherein said number GI is defined as the greater value of said two values Vmax and Hmax.

2. (Original) The method of Claim 1, wherein in said step a) said green pixel values are taken from a line buffer adapted for buffering pixel values to be used for performing image interpolation.

3. (Original) he method of Claim 1, wherein in said step a) the intensity of spatial frequency of said current processing pixel is determined using exclusively said green pixel values.

Cancel claims **4-7.**

8. (Currently Amended) The method of Claim **1**, wherein in said step b) said number GI is used to

set the amount of reduction to be performed on the chromatic saturation of said current processing pixel.

9. (Currently Amended) A method for performing chroma suppression for an image sensor system,

said method comprising the steps of:

a) determining whether or not a current processing pixel within a region of Bayer pattern is a green pixel;

b) irrespective of whether said current processing pixel being a green pixel or a non-green pixel, accessing the pixel values of green pixels within said region of Bayer pattern that surround said current processing pixel;

c) calculating the intensity of spatial frequency of said current processing pixel using said accessed green pixel values; and

d) reducing the chromatic saturation of said current processing pixel based on said calculated intensity of spatial frequency;

wherein said step c) is performed during edge detection, wherein said accessed green pixel values are taken from a line buffer adapted for buffering pixel values to be used for performing image interpolation.

Cancel claim **10.**

11. (Currently Amended) A chroma suppression system for performing chroma suppression in an image sensor system, said chroma suppression system comprising:

an edge detection module adapted to detect edge within a Bayer pattern region, said edge detection module adapted for determining the intensity of spatial frequency of a current processing pixel by using green pixel values within said Bayer pattern region; and

a chroma suppression module coupled to said edge detection module, said chroma suppression module adapted to reduce the chromatic saturation of said current processing pixel based on said determined spatial frequency intensity of said current processing pixel;

wherein said edge detection module is adapted to perform the steps comprising of:

a) calculating a first plurality of 4 first order pixel value sums V[0] to V[3], wherein an i-th pixel value sum V[i] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying on the i-th vertical column of said Bayer pattern region; and

b) calculating a second plurality of 4 first order pixel value sums H[0] to H[3], wherein an j-th pixel value sum H[j] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying in the j-th horizontal column of said Bayer pattern region;

wherein said region of Bayer pattern is a 4 X 4 block of pixels containing said current processing pixel.

wherein said edge detection module is further adapted to perform the steps comprising of:

c) calculating Vavg[0] = V[0] + V[2] and Vavg[1] = V[1] + V[3];

d) calculating Vmax = | Vavg[0] -Vavg[1] |;

e) calculating Havg[0] = H[0] + H[2] and Havg[1] = H[1] + H[3]; and

f) calculating Hmax = | Havg[0] - Havg[1] |;

wherein a number GI is used by said edge detection module to indicate the intensity of spatial frequency of said current processing pixel, wherein said number GI is defined as the greater of said two values Vmax and Hmax.

12. (Original) The chroma suppression system of Claim 11, wherein said green pixel values are taken from a line buffer of an image interpolation module of said image sensor system, said line buffer adapted for buffering pixel values to be used for performing image interpolation.

13. (Original) The chroma suppression system of Claim 11, wherein said edge detection module determines the intensity of spatial frequency of said current processing pixel by using exclusively said green pixel values within said Bayer pattern region.

Cancel claims **14-17.**

18. (Currently Amended) The chroma suppression system of Claim **11,** wherein said number GI is used as a reference by said chroma suppression module for setting the amount of reduction to be performed on the chromatic saturation of said current processing pixel.

19. (Currently Amended) A method for performing chroma suppression for an image sensor system,

said method comprising the steps of:

a) irrespective of whether a current processing pixel being a green pixel or a non-green pixel, accessing the pixel values of Bayer pattern green pixels within a region of Bayer pattern that contains a current processing pixel;

b) determining the spatial frequency of said current processing pixel using said accessed green pixel values; and

c) reducing the chromatic saturation of said current processing pixel based on said determined spatial frequency of said current processing pixel;

wherein said step b) further comprises the steps of: bl) calculating a first plurality of 4 first order pixel value sums V[0] to V[3], wherein an i-th pixel value sum V[i] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying on the i-th vertical column of said Bayer pattern region; and

b2) calculating a second plurality of 4 first order pixel value sums H[0] to Hl3], wherein an j-th pixel value sum H[j] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying in the j-th horizontal column of said Bayer pattern region;

wherein said region of Bayer pattern is a 4 X 4 block of pixels containing said current processing pixel.

wherein said step b) further comprises the steps of:

b3) calculating Vavg[0] = V[0] + V[2] and Vavg[1] = V[1] + V[3];

b4) calculating Vmax = | Vavg[0] - Vavg[1] |;

b3) calculating Havg[0] = H[0] + H[2] and Havg[1] = H[1] + H[3]; and

b4) calculating Hmax = | Havg[0] - Havg[1] |;

wherein a number GI is used to determine the intensity of spatial frequency of said current processing pixel, wherein said number GI is defined as the greater of said two values Vmax and Hmax.

20. (Original) The method of Claim 19, wherein in said step a) said pixel values of said green pixels are taken from a line buffer of an color interpolation module of said image sensor system, said line buffer adapted to buffer pixel values to be used for performing color image interpolation.

21. (Original) The method of Claim 19, wherein in said step b) the intensity of spatial frequency of said current processing pixel is calculated using exclusively said green pixel values from said region of Bayer pattern.

Cancel claims **22-25**.

26. (Currently Amended) The method of Claim **19**, wherein in said step c) said number GI is used to set the amount of suppression to be performed on said current processing pixel.

27. (Currently Amended) A method for improving quality of an image captured by an image sensor system, said method comprising the steps of:

a) locating area of said captured image that has spatial frequency higher than a reference value by using edge detection, wherein said edge detection uses a plurality of green pixels surrounding a current processing pixel to determine the intensity of spatial frequency of said current processing pixel; and

b) chroma suppressing said located area based on said determined spatial frequency intensity of said current processing pixel

wherein said plurality of green pixels are taken from a line buffer of an image interpolation unit of said image sensor system, wherein said line buffer is adapted to buffer pixel values to be used for performing image interpolation.

Cancel claim **28.**

29. (Original) The method of Claim 27, wherein said step b) further comprises the step of:

reducing the chromatic saturation of said current processing pixel based on the said determined spatial frequency intensity of said current processing pixel.

30. (Currently Amended) A method for performing chroma suppression for an image sensor system, said method comprising the steps of:

a) finding the intensity of spatial frequency for a current processing pixel within a block of Bayer pattern by using a plurality of green pixel values from said block of Bayer pattern, said green pixel values selected from pixel values adapted to be used for image interpolation; and

b) suppressing the chromatic saturation of said current processing pixel based on said found intensity of spatial frequency of said current processing pixel;

wherein said region of Bayer pattern is a 4 X 4 block of pixels containing said current processing pixel.

wherein said step a) further comprises the steps of:

a1) calculating a first plurality of 4 first order pixel value sums V[0] to V[3],

wherein an i-th pixel value sum Vii] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying on the i-th vertical column of said Bayer pattern region; and

a2) calculating a second plurality of 4 first order pixel value sums H[0] to H[3], wherein an j-th pixel value sum H[j] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying in the j-th horizontal column of said Bayer pattern region;

wherein said step a) further comprises the steps of:

a3) calculating Vavg[0] = V[0] + V[2] and Vavg[1] = V[1] + V[3];

a4) calculating Vmax = I Vavg[0] - Vavg[1] I;

a3) calculating Havg[0] = H[0] + H[2] and Havg[1] = H[1] + HI3]; and

a4) calculating Hmax = I Havg[0] - Havg[1] I;

wherein a number GI is used to determine the intensity of spatial frequency of said current processing pixel, wherein said number GI is defined as the greater value of said two values Vmax and Hmax.

31. (Original) The method of Claim 30, wherein said plurality of green pixel values are taken from a line buffer adapted for buffering pixel values to be used for image interpolation.

32. (Original) The method of Claim 30, wherein in said step a) the intensity of spatial frequency of said current processing pixel is determined using steps performed for edge detection, wherein said edge detection steps utilize pixels values of said green pixels within said block of Bayer pattern.

33. (Original) The method of Claim 32, wherein in said step a) the intensity of spatial frequency of said current processing pixel is determined using exclusively said buffered green pixel values.

Cancel claims **34-37.**

38. (Currently Amended) The method of Claim **30,** wherein in said step b) said GI is used to set the amount of suppression to be performed on said current processing pixel.

39. (Currently Amended) A chroma suppression system for performing chroma suppression in an image sensor system, said chroma suppression system comprising:

an edge detection unit adapted for detecting false color of a current processing pixel by using the intensity of spatial frequency of said current processing pixel; and

a chroma suppression unit coupled to said edge detection unit, said chroma suppression unit adapted for reducing the chromatic saturation of said current processing pixel in response to false color being detected for said current processing pixel, wherein the amount of chromatic saturation reduction is performed according to the intensity of spatial frequency of said current processing pixel;

wherein said intensity of spatial frequency of said current processing pixel is determined without needing to use pixel values of non-green pixels surrounding said current processing pixel;

wherein said intensity of spatial frequency of said current processing pixel is determined using green pixel values of a plurality of green pixels surrounding said

current processing pixel, said green pixel values taken from a line buffer adapted for buffering pixel values to be used for performing image interpolation.

Cancel claims **40-41.**

Drawings

2. Drawings filed 9/11/03 have been approved by the examiner.

Allowable Subject Matter

3. The following is an examiner's statement of reasons for allowance:

Claims 1-3, 8-9, 11-13, 18-21, 26-27, 29-33 and 38-39 (renumbered as 1-21) are allowed.

The present invention is directed for performing chroma suppression for an image sensor system. Non of the prior art on record teaches or fairly suggests, determining the intensity of spatial frequency for a current processing pixel within a block of Bayer pattern by using edge detection that utilizes pixels values of green pixels within the block of Bayer pattern and reducing the chromatic saturation of the current processing pixel based on the determined intensity of spatial frequency of the current processing pixel, wherein the region of Bayer pattern is a 4 X 4 block of pixels containing said current processing pixel wherein the determining step further comprises the steps of: calculating a first plurality of 4 first order pixel value sums V[0] to V[3], wherein an i-th pixel value sum V[i] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying on the i-th vertical

column of the Bayer pattern region; and calculating a second plurality of 4 first order pixel value sums HI0] to H[3], wherein an j-th pixel value sum H[j] characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying in the j-th horizontal column of the Bayer pattern region and wherein the determining step further comprises the steps of: calculating Vavg[0] = V[0] + V[2] and Vavg[1] = V[1] + V[3]; calculating Vmax = | Vavg[0] - Vavg[1] |; calculating Havg[0] = H[0] + H[2] and Havg[1] = H[1] + H[3]; and calculating Hmax = | Havg[0] - Havg[1] |; and wherein a number GI is used to determine the intensity of spatial frequency of said current processing pixel, wherein said number GI is defined as the greater value of said two values Vmax and Hmax as recited in claims 1,11,19 and 30. Furthermore, the prior art fails to teach calculating the intensity of spatial frequency of the current processing pixel using the accessed green pixel values wherein the accessed green pixel values are taken from a line buffer adapted for buffering pixel values to be used for performing image interpolation as recited in claims 9 and 27. Furthermore, the prior art also fails to teach for reducing the chromatic saturation of the current processing pixel in response to false color being detected for the current processing pixel, wherein the amount of chromatic saturation reduction is performed according to the intensity of spatial frequency of the current processing pixel as recited in claim 39. The closest prior art to Glotzbach et al. (US 6,975,354 B2) and Fukui et al. (US 7,113,207 B2) disclose the conventional method for edge enhancement, false color suppression, chrominance signal processing, but either singularly or in combination, fail to anticipate or render the above limitations obvious.

4. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Other prior art cited

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Tusji (US 4,974,066) discloses a circuit for preventing high-intensity false color caused by color separation filters.

Hashimoto (US 4,480,266) discloses a method and apparatus for preventing generation of false color signals in color television cameras.

Vijayakumar et al. (US 6,766,281 b1) disclose a matched texture filter design for rendering multi-rate data sample.

Acharya et al. (US 6,094,508) disclose a perceptual thresholding for gradient-based local edge detection.

Skow (US 7,102,669) discloses a digital color image pre-processing.

Hung (US 6,829,016) discloses a digital still camera system and method.

Contact Information

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kanji Patel whose telephone number is (571) 272-7454. The examiner can normally be reached on Monday to Thursday from 8 a.m. to 6:30 p.m. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lillis Eileen can be reached on (571) 272-6928 The fax phone number for the organization where this application or proceeding is assigned is (571)-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kanji Patel
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2/02/07

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